SUPPORT FOR THE AMENDMENTS

The present amendment adds new claims 29 and 30. Support for these amendments is provided by the originally filed claims and specification. Support for newly added claims 29 and 30 can be found, for example, at paragraphs [0066]-[0071], and original claim 8, of Iwakuma '698 (U.S. 2007/0172698), which is the U.S. pre-grant publication of the originally filed application. It is believed that these amendments have not resulted in the introduction of new matter.

REMARKS

Claims 3-19 and 21-30 are currently pending in the present application. Claims 29 and 30 have been added by the present amendment.

The rejections under 35 U.S.C. § 103(a) of: (1) claims 3-6, 8-10, 12, 14-19 and 21-25 as being obvious over Higashi (U.S. Patent 6,617,051) in view of Begley (U.S. 2005/0095453); (2) claims 7, 11 and 13 as being obvious over Higashi in view of Begley and Hu (U.S. Patent 6,479,172); and (3) claims 26-28 as being obvious over Higashi in view of Begley and Iwakuma '745 (U.S. 2004/0086745), are respectfully traversed, with respect to claims 3-19 and 21-30, and the disclosure of Seo (U.S. 2002/0028349).

Claim 3 recites an organic electroluminescent device in which an organic thin film layer comprising a single layer or plural layers comprising a *phosphorescent* light-emitting layer comprising at least a host material and a *phosphorescent* organic metal complex is interposed between a cathode and an anode, wherein a halogen element mass concentration of *bromine* which is contained as an impurity in the host material of the phosphorescent light-emitting layer is *30 ppm or less*.

Higashi, Begley, Hu and Iwakuma '745, when considered alone or in combination, fail to disclose or render obvious to a skilled artisan the organic electroluminescent device of the present invention, which comprises a *phosphorescent* light-emitting layer comprising a host material and a *phosphorescent* organic metal complex, wherein a halogen element mass concentration of *bromine* which is contained as an impurity in the host material of the *phosphorescent* light-emitting layer is *30 ppm or less*, as presently claimed.

Higashi describes an organic electroluminescent device comprising an organic compound layer comprising an organic emitting layer, wherein the organic compound layer comprises an organic compound material having a *halogen-containing compound* impurity concentration of *lower than 1,000 ppm, including lower than 500 ppm and 0 ppm*, and wherein the organic emitting layer comprises a host light-emitting material and a *fluorescent dopant* (e.g., DPAVBi) (See e.g., abstract,

column 1, lines 56-60, column 2, lines 1-32, column 3, lines 6-15, column 22, lines 36-45, column 29, lines 41-44, column 32, lines 39-49, column 36, lines 1-18, column 41, Table 2 and lines 26-30, column 43, lines 15-21, claims 9, 10 and 15-18).

As acknowledged on page 4, lines 2-3 of the Official Action, Higashi fails to describe an organic electroluminescent device comprising a *phosphorescent* light-emitting layer comprising a *phosphorescent* organic metal complex, as presently claimed. As a result, Higashi necessarily fails to disclose or suggest that a halogen element mass concentration of *bromine* which is contained as an impurity in the host material of the *phosphorescent* light-emitting layer is *30 ppm or less*, as presently claimed.

Begley fails to compensate for the above-mentioned deficiencies of Higashi. Begley describes and exemplifies an organic electroluminescent device comprising a light-emitting layer comprising a host material and a *fluorescent* dopant (e.g., fluorescent rubrene dopant), wherein the dopant is *usually* a *fluorescent* dye (See e.g., [0049], [0051], [0153], [0169], [0114]-[0115]). Begley *merely mentions* that a phosphorescent dopant *may* also be used in the light-emitting layer (See e.g., [0115]). Moreover, Begley is *completely silent* as to the *concentration* of *halogen impurities* present in a *phosphorescent* light-emitting layer. Therefore, Begley clearly fails to compensate for the above-mentioned deficiencies of Higashi.

A skilled artisan would not have been motivated to particularly select the *phosphorescent dopant* briefly mentioned in Begley over the *particularly preferred fluorescent rubrene dopants* described and exemplified therein, for incorporation into the organic emitting layer of Higashi comprising a host light-emitting material and a *fluorescent dopant*, absent impermissible hindsight reconstruction, thereby precluding a *prima facie* case of obviousness.

Assuming arguendo that sufficient motivation and guidance is considered to have been provided by the combined disclosures of Higashi and Begley to direct a skilled artisan to particularly select the *phosphorescent dopant* briefly mentioned in Begley over the *particularly preferred*

fluorescent rubrene dopants described and exemplified therein, for incorporation into the organic emitting layer of Higashi comprising a host light-emitting material and a *fluorescent dopant*, which is clearly not the case, Higashi and Begley fail to disclose or reasonably suggest to a skilled artisan that a halogen element mass concentration of *bromine* which is contained as an impurity in the host material of the *phosphorescent* light-emitting layer is *30 ppm or less*, as presently claimed, thereby precluding a prima facie case of obviousness.

The Examiner alleges in item 1 on page 11 of the Official Action that it would have been obvious for a skilled artisan to arrive at the claimed halogen element mass concentration of *bromine* which is contained as an impurity in the host material of the *phosphorescent* light-emitting layer of *30 ppm or less* since Higashi describes the desirability of reducing *halogen-containing compound* impurity concentrations to *lower than 1,000 ppm, including lower than 500 ppm and 0 ppm* in order to improve device performance since the harmful nature of such halogen contamination is already known.

Applicants respectfully disagree for at least the following reasons.

Seo (U.S. 2002/0028349) describes that *phosphorescence* emission of an organic electroluminescent device is *promoted* by *incorporating* a heavy atom (e.g., *particularly bromine*) into a *phosphorescent* light emitting material (See e.g., abstract, [0023]-[0027]). On the other hand, Higashi describes that halogens are impurities and suggests reducing such impurities to concentrations *lower than 1,000 ppm, including lower than 500 ppm and 0 ppm*, in order to improve device performance. Based on the combined disclosures of Higashi, Begley and Seo, it is unclear to a skilled artisan whether the presence of bromine impurity in a phosphorescent light emitting material actually improves or reduces phosphorescence emission.

As a result, skilled artisan would neither have been motivated nor had a reasonable expectation of success to arrive at the organic electroluminescent device of the present invention, which comprises a *phosphorescent* light-emitting layer comprising a host material and a *phosphorescent* organic metal

complex, wherein a halogen element mass concentration of *bromine* which is contained as an impurity in the host material of the *phosphorescent* light-emitting layer is *30 ppm or less*, as presently claimed, based on the combined disclosures of Higashi, Begley and Seo, absent impermissible hindsight reconstruction, thereby precluding a *prima facie* case of obviousness.

Assuming arguendo that sufficient motivation and guidance is considered to have been provided by Higashi, Begley, Hu and/or Iwakuma '745 to direct a skilled to arrive at the organic electroluminescent device of the present invention, which is clearly not the case, such a case of obviousness is rebutted by a showing of unexpected results.

Applicants have discovered that an organic electroluminescent device, which comprises a phosphorescent light-emitting layer having a bromine mass concentration of only 30 ppm or less, surprisingly exhibited a remarkable degree of improvement with respect to drastically enhanced performance, prolonged half lifetime, and desirably reduced operating/driving voltage.

As discussed in the present specification and shown by the comparative experimental data presented therein, Applicants have discovered that an organic electroluminescent device, which comprises a phosphorescent light-emitting layer having a bromine mass concentration of only 30 ppm or less in accordance with an exemplary aspect of the present invention, surprisingly exhibited a remarkable degree of improvement with respect to drastically enhanced performance, prolonged half lifetime, and desirably reduced operating/driving voltage, as compared to the inferior properties of decreased performance, shortened half lifetime, and undesirably increased operating/driving voltage exhibited by a traditional organic electroluminescent device, which comprises a conventional phosphorescent light-emitting layer having a bromine mass concentration outside the claimed range of 30 ppm or less (See e.g., abstract, paragraphs [0001], [0012], [0023]-[0030], [0039]-[0045], [0048], [0141]-[0144], [0147]-[0149], [0178]-[0186], [0204], Figs. 1, 2, 4 and 5, as well as original claim 3, of Iwakuma '698 (U.S. 2007/0172698), which is the U.S. pre-grant publication of the originally filed application).

As shown in Table A below, which compiles into tabular form the comparative experimental data presented in the present specification, the inventive organic electroluminescent device 2 of Example 1 comprising a phosphorescent light-emitting layer having a bromine mass concentration of 30 ppm or less in accordance with an exemplary aspect of the present invention surprisingly exhibited superior properties with respect to an unexpectedly reduced operating/driving voltage of only 1.15 V and an unexpectedly prolonged half lifetime of 467 hours.

In contrast, the traditional organic electroluminescent device 1 of Comparative Example 1 comprising a conventional phosphorescent light-emitting layer having a bromine mass concentration outside the claimed range of 30 ppm or less exhibited inferior properties with respect to an undesirably increased operating/driving voltage of 1.51 V and a shortened half lifetime of only 70 hours.

Table A

Device	Example	Br (ppm)	I (ppm)	Cl (ppm)	Total Halide (ppm)	Operating/ Driving Voltage (V)	Half Lifetime (Hours)
1	Comp. Ex. 1	325	10	22	357	1.51	70
2	Ex. 1	17	5	7	29	1.15	467

As shown in Table B below, which compiles into tabular form the comparative experimental data presented in the present specification, the inventive organic electroluminescent device 5-7 of Examples 3-5, respectively, comprising a phosphorescent light-emitting layer having a bromine mass concentration of 30 ppm or less in accordance with an exemplary aspect of the present invention surprisingly exhibited superior properties with respect to an unexpectedly reduced operating/driving voltage of only 0.45 V, 0.21 V, and 0.24 V, respectively, and an unexpectedly prolonged half lifetime of 1083 hours, 3988 hours and 4623 hours, respectively.

In contrast, the traditional organic electroluminescent device 8 of Comparative Example 3 comprising a conventional phosphorescent light-emitting layer having a bromine mass concentration outside the claimed range of 30 ppm or less exhibited inferior properties with respect to an undesirably increased operating/driving voltage of 0.92 V and a shortened half lifetime of only 57 hours.

Table B

Device	Example	Br (ppm)	I (ppm)	Cl (ppm)	Total Halide (ppm)	Operating/ Driving Voltage (V)	Half Lifetime (Hours)
5	Ex. 3	24	5	4	33	0.45	1083
6	Ex. 4	16	4	5	25	0.21	3988
7	Ex. 5	13	4	3	20	0.24	4623
8	Comp. Ex. 3	390	10	10	410	0.92	57

This evidence clearly demonstrates that the claimed organic electroluminescent device comprising a phosphorescent light-emitting layer having a bromine mass concentration of 30 ppm or less in accordance with an exemplary aspect of the present invention surprisingly exhibits superior properties with respect to an unexpectedly reduced operating/driving voltage and an unexpectedly prolonged half lifetime. This evidence also demonstrates the important influence that bromine mass concentration has on the properties exhibited by an organic electroluminescent device comprising a phosphorescent light-emitting layer containing bromine.

The present invention offers a new precept regarding the treatment of bromine in a phosphorescent light emitting device. Based on the combined disclosures of the cited references and Seo, one of ordinary skill in the art could not have reasonably predicted with a reasonable expectation of success that the operative/driving voltage and the half lifetime of the organic electroluminescent device could be drastically reduced and prolonged, respectively, by limiting the bromine mass concentration to an amount of 30 ppm or less, as presently claimed, thereby precluding a prima facie case of obviousness.

Withdrawal of these grounds of rejections is respectfully requested.

In conclusion, Applicants submit that the present application is now in condition for allowance and notification to this effect is earnestly solicited.

Respectfully submitted,

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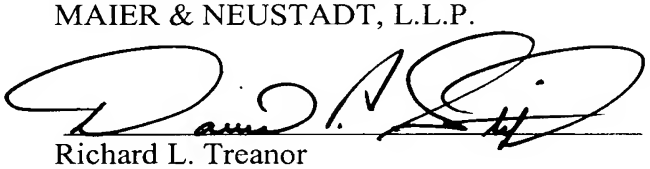

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